1. JP,09-510930,A(1997)

* NOTICES *

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CLAIMS

[Claim(s)]
1. It is housing (6) of a work piece, especially an electric switch. Are welded by the laser beam (11) along with a part for a joint (10). Plastics and the two work-piece sections (7 8) which consist of thermoplastic material preferably are prepared, and the two work-piece sections (7 8) are set to a subsegment at least to the spectrum of a laser beam (11). It has a mutually different transmission coefficient and a mutually different absorption coefficient, the first work-piece section (8) is set to the field for the first bond part (12), and it is a laser beam (11).
Even if few, are made as [penetrate / partially], and a laser beam (11) invades into a part for the joint of the first work-piece section (8) (10). A part of laser beam (11) penetrates the first work-piece section (8) by that cause. The second work-piece section (7) is a work piece currently made as [absorb / a laser beam (11) / in / further / invade into the second work-piece section (7) by part for the second bond part (13), and / the field for the second bond part (13) for a joint (10) / at least / partially].
2. It is the work piece according to claim 1 as which it is made as [absorb / on the front face for the second bond part (13) / the second work-piece section (7)], and/or the wavelength of a laser beam (11) is chosen so that a several microns laser beam (11) may invade into the second work-piece section (7) preferably slightly.

3. The plastics with the two same work-piece sections (7 8), for example, a styrene acrylonitrile copolymer, A glass fiber [in / the transmission coefficient of the first work-piece section (8) and the absorption coefficient of the second work-piece section (7) are desirable, and / it consists of a polyamide etc. and / plastics], Without especially in the case of absorption plastics adjusting "Additives, such as a pigment, especially a black pigment, be comparatively alike", coloring with 1% - 2% of color, in the case of transparency plastics coloring a lower rate or coloring probably Furthermore, the plastics of both work-piece sections (7 8) is a work piece according to claim 1 or 2 with suitable not penetrating the spectrum of a visible ray on parenchyma.
4. It is related with the laser beam (11) in contact with a part for the bond part of a work piece (7 8) (12 13). Respectively The first work-piece section (8) 60% or more of permeability T, 30% or less of absorption coefficient A The work piece according to claim 1, 2, or 3 in which it has 20% or less of reflection factor R, and the second work-piece section (7) has 10% or less of reflection factor R especially when required, 90% or more of absorption coefficient A, very few permeability T, and when required.
5. Set Work-Piece Section (7 8) Which Should be Connected to a Part for Joint (10). Lap joint (9) and when required, the lap joint of a wedge configuration (18), Groove lap joint (23), shoulder-like lap joint (9, 19, 21, 22), Have contiguity lap joint (17) etc. and a part for a joint (10) is preferably prepared in three-dimensions space along with connection of the work-piece section (7 8). A work piece given in either of claims 1-4 with convenient furthermore being located in the interior of a work piece for a joint [a part of] (10).
6. Wall (26) Demarcated by a Part of Inside Cavity [at Least] (27) is Prepared in Two Work-Piece Sections (7 8). The amount of (10) joint consists of each partition (28) preferably. This partition The angle of a wall (26), It is prepared in fields, such as a penetration part of a cavity (27), and continues along the connection front face of the wall (26) which adjoins mutually. Furthermore, a work piece given in either of claims 1-5 with suitable carrying out the seal especially of the cavity (27) from dust, when walls (26) overlap by snap connection (29), a seal groove (24), etc. mutually between each partitions (28).
7. Plastics, Work-Piece Section Given in Either of Claims 1-6 Which Consists of Thermoplastic Material Preferably (7 8), It is the approach of welding the housing section of an electric switch etc. by the laser beam (11) especially. The first transparency work-piece section (8) and the second absorption work-piece section (7) are mutually connected by part for a joint (10). So that a work piece may be formed and a laser beam

(11) may hit the first work-piece section (8) in a part for the first bond part (12) first The two work-piece sections (7 8) and the source of a laser beam (1) are mutually positioned relatively by the optical system (3). A part of laser beam (11) penetrates the first work-piece section (8) by that cause. This part of a laser beam (11) trespasses upon the field for the second bond part (13) for a joint (10) of the second work-piece section (7) next. Thereby, for the second work-piece section (7), it will be [in / the field for the second bond part (13) is heated consequently / a part for a joint (10)] in a melting condition, a part for a joint (10) is solidified at the time of the next cooling, and the two work-piece sections (7 8) are the two work-piece sections (7 8). The first work-piece section (8) sets including ******, an additive, especially a pigment to the field from a part for the first bond part (12) to a part for a joint (10). So that the spectrum of a laser beam (11) may be penetrated partially at least By changing the rate of an additive, the work-piece section (7 8) is adjusted and sets the second work-piece section (7) to the field for the second bond part (13). The reflection factor of the two work-piece sections [as opposed to / absorb the spectrum of a laser beam (11) partially at least, and / the spectrum of a visible ray] (7 8) is a parenchyma top and the same approach.

8. So that it may be located almost perpendicularly by the amount of (13) part for the first bond part (12), and second bond part especially to this line on parenchyma on the straight line currently formed of the laser beam (11) in the two work-piece sections (7 8) The source of a laser beam (1) is located so that a laser beam (11) may be turned by the optical system (3), a part for a long and slender joint (10) is formed, and orientation is possible to arbitration. So that it may be prepared in three-dimensions space in the shape of a partition (28) in a work piece in each location It is the welding process of the work-piece section according to claim 7 which the optical system (3) and the work-piece section (7 8) of the source of a laser beam (1) or the source of a laser beam (1) move by programmable motion of a robot, multiaxial handling equipment, etc. relative especially mutually preferably.

9. At the time of heating and melting for a joint (10) by the laser beam (11) Or a pressure acts on the field for a joint (10) to cooling for a joint (10) especially after that. Preferably, in accordance with the focus of a laser beam (11), especially a pressure pursues a laser beam (11), or acts on the work-piece section (7 8) on the outside of the path of a laser beam (11). It is the welding process of the work-piece section according to claim 7 or 8 to which a pressure operation is brought by the presser-foot equipment which can penetrate the laser beam (11) of water pressure, pneumatic pressure, and the shape of a roller (16) and others preferably.

10. It is the welding process of the work-piece section according to claim 7, 8, or 9 with which welding stress is mitigated by carrying out automatic control of the operation parameter of Nd:YAG laser as a function of process parameters, such as a source of a laser beam (1), temperature in a part for a joint (10), and a pressure, and annealing a work piece after welding preferably.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
A plastics work piece and its manufacture approach This invention relates to the welding process of a work piece especially housing of an electric switch given in pre AMBURU of patent claim 1, and the work-piece section given in pre AMBURU of patent claim 7.
Housing which consists of plastics of an electric switch can hold electrical parts, such as a stationary contact and a switch contact, and other components. Generally housing is usually formed from two or more housing sections of the shape of a complicated space form. The housing section must be attached at the time of the assembly of a switch, and it must connect often certainly between the housing sections. Since such connection must be made according to the profile of the housing section, it has the configuration of three-dimensions space.
When especially housing needs to be sealed from an outside, it is known that the housing section will be mutually connected by ultrasonic welding. In this case, the soldered joint and the electrical part itself of an electrical part are destroyed by supersonic vibration, and there is a problem that a switch becomes unusable. Therefore, there is the need for the approach of welding the housing section of an electric switch, without bringing a bad influence to an electrical part.
It is common knowledge to weld plastic film of each other by the laser beam from the German patent official report 3621030. For this purpose, plastic film is loaded in the shape of a layer. Next, the laser beam which converged passes a film, and a film is heated by part for a joint so that it may be in a melting condition, and it fixes by part for a joint after cooling.
Since a film is a thin part, heating of the whole joint part is possible for it at the time of passage of a laser beam. Usually, welded connection acceptable between films by that cause is attained. Since only the front face of a work piece can be heated by the well-known junction approach when it is a thick work piece like housing of an electric switch however, usable welded connection of the two work-piece sections cannot be attained. In the case of the housing section of an electric switch, a part especially for a joint is often prepared inside housing by the reasons of a design. Thus, the connection welded inside is clearly impossible by the well-known junction approach.
Furthermore, the welding process of the sheet plastic by the laser beam is common knowledge from EP-A2-0159169. In the case of this approach, the second sheet is prepared on the first sheet and it is made as [absorb / a laser beam] by using an additive for plastics. In the case of a black color many, carbon black is used as an additive. Since the plastics of the second sheet does not contain an additive, the second sheet makes a laser beam penetrate considerably.
Next, melting of the contact surface of the sheet of two sheets which a laser beam acts on the second sheet, and a laser beam is absorbed by the first sheet after passing the second sheet, consequently adjoins mutually is carried out, and it is mutually combined at the following cooling process.
By this approach, since the second sheet cannot contain an additive, it cannot color, but while it is opalescence, the first sheet has the problem that it is colored with a black color. The work piece manufactured by that cause follows, and since it is formed from the part of a very different color, overall visual impressions are spoiled. However, in the case of housing of an electric switch, the whole housing needs to give the vision impression of homogeneity especially about a color. The sheet furthermore shown in the official report forms the flat surface on a flat surface welded mutually. However, generally, in the case of an electric switch etc., especially the housing section has a complicated configuration, and since the amount of [to which the housing section is connected mutually] joint must meet this configuration, it is not limited to the whole surface. About the manufacture for a joint of complicated space, nothing is stated to the specification of an official report. Therefore, especially the well-known approach is not suitable for welding

of the housing section of an electric switch.
This invention is based on the purpose which designs the work piece formed from two or more work-piece sections so that the work-piece section can connect mutually by the laser beam in a part for the joint of inside three-dimensions space especially, and specifies the manufacture approach of such a work piece. This purpose is attained by the approach belonging to the work piece belonging to the description according to claim 1, and the description according to claim 7.
The first work-piece section is passed without a laser beam's being a location nearest to the source of a laser beam, and barring this invention on parenchyma, and it is considerably absorbed by the second work-piece section, and is based on the concept that melting of the two work-piece sections is carried out in a part for a joint by that cause. For this purpose, the first work-piece section is made as [penetrate / considerably / a laser beam] in the part which the laser beam contacted at least, and the second work-piece section is made as [absorb / considerably / a laser beam] by adding an additive at a suitable rate. For this reason, the first work-piece section has a high transmission coefficient and a low absorption coefficient compared with the second work-piece section. That is, the first work-piece section has a transmission coefficient higher than the second work-piece section, and the second work-piece section has an absorption coefficient higher than the first work-piece section.
However, since both contain an additive, the work-piece section has impermeability to the beam of light of the visible range of human being's eyes, and, thereby, has on parenchyma the advantage of giving a uniform impression. Discernment by vision is impossible for each work-piece section on parenchyma after welding.
The further improving point of this invention is the summary of a subordination term.
Especially the second work-piece section can be made as [absorb / on a front face / so that a laser beam cannot penetrate the second work-piece section slightly]. Therefore, a good result is obtained even for a low laser output at the time of welding. Although the transmission coefficient of the two work-piece sections shows extent of transparency and the absorption coefficient shows extent of absorption, these can be adjusted by adding the additive of a pigment to plastics.
The convenient thing was discovered, when the first work-piece section was adjusted by 60% or more of permeability T, and 30% or less of absorption coefficient A and the second work-piece section was adjusted by 90% or more of an absorption coefficient A and very few especially permeability T.
Especially, in the case of the complicated work piece of a configuration, a part for a joint can be prepared in three-dimension space also in the interior of a work piece, consequently a work piece can be made the the best for each meant use. Since the wall of the work-piece section which adjoins mutually can be mutually piled up in order to fully carry out the seal of the inside of a work piece, in a part for a joint, critical parts, such as an angle and a through tube, are fully joinable by welding of the letter of a partition with a laser beam. The work-piece section which should be connected mutually can have the lap joint of various configurations in a part for a joint.
Whenever [for a joint / junction] can be further increased by applying a pressure to a part for a joint until it is cooled. A pressure acts in accordance with the focus of a laser beam preferably, consequently the transparency to the work piece of a laser beam is not barred. However, a pressure can act on the operation field of a laser beam directly by using a clamp means to make a laser beam penetrate. Suitably, a pressure acts so that a motion of a laser beam may be pursued along with a part for a joint. Such a motion of a laser beam can be spatially attained easily by the programmable approach, when a robot or a multiaxial processor is used. Especially, the letter of a partition can be welded easily in each location of a work piece.
Furthermore, the manufacture approach can be optimized by controlling the operation parameter of the source of a laser beam by the approach equivalent to the measurement process parameter in a part for a joint like a pressure and temperature automatically.
Especially by this invention, when welding to the configuration which overlaps or adjoins, welding of high quality can be attained and the advantage that welding is partially performed even for a work piece especially with a thick wall at least inside is attained by the laser beam. Unlike the conventional ultrasonic welding, the configuration of welding can be freely doubled with the requirements on a design. That is, in housing, it can weld spatially by request. Since a welding path can be formed by programming the beam path of a laser beam and moving a work piece, manufacture of various work pieces is possible for it. Being able to weld the work-piece section only by heating, in actual welding, an additive is not still more nearly required. Especially in manufacture of an electric switch, since it is not necessary to worry about destruction of an electrical part, trash is avoided.
Below, the suitable example of this invention is stated to a detail, and is shown in a drawing. In a drawing Drawing 1 is the schematic drawing of the welding equipment of electric switch housing. drawing 2 is the

longitudinal direction sectional view of housing. Drawing 3 is the enlarged drawing of the X section of drawing 1 . drawing 4 is some longitudinal direction sectional views of housing of the further example. drawing 5 is some longitudinal direction sectional views of housing of the further example. drawing 6 is the longitudinal direction sectional view of the wall of housing of another example. Drawing 7 is the longitudinal direction sectional view of the wall of housing of still more nearly another example. the longitudinal direction sectional view of the wall of housing of example with drawing 8 another again -- it is -- the sectional view of housing of the space design with complicated drawing 9 -- it is -- and -- Drawing 10 is a sectional view which meets the line 10-10 of drawing 9 .

The outline of the equipment for welding the work-piece section by the laser beam is shown in drawing 1 by the approach by this invention. Equipment can be equipped with the outlet of the light connected to the source 1 of a laser beam, for example, Nd:YAG laser, and the optical system 3 by the flexible lightguide 2, consequently the source 1 of a laser beam can be established in a desired spatial position. The optical system 3 is movable by the control unit by the driving gear as it is prepared on the work-piece holder 4, for example, is shown by the direction arrow head 5 of drawing 1 . Naturally, the optical system 3 can also be designed movable.

The components of the work-piece section 6 which should be mutually welded to the work-piece holder 4, i.e., housing, are prepared suitably, and housing 6 is housing of an electric switch in this example. Housing 6 is equipped with the housing cover 8 which is the housing base 7 and the first work-piece section of a pot configuration which form the two housing sections, i.e., the second work-piece section. the housing base 7 and a housing cover 8 -- both -- plastics -- it consists of thermoplastic material preferably. The housing base 7 has the shoulder 9 surrounded annularly, and the housing cover 8 is laid on the shoulder 9 as shown in the detail at drawing 2 . At the shoulder 9, a housing cover 8 meets a part for the joint 10 surrounded annularly continuously, and is welding **** to the housing base 7 by the laser beam. Consequently, since the housing 6 of an electric switch is sealed, it is especially protected from dust.

Furthermore, a housing cover 8 and the housing base 7 are heated by the laser beam 11 so that drawing 1 may show. A laser beam is emitted to housing 6 along with a part for a joint 10 from the optical system 3 so that the housing base 7 and a housing cover 8 may be in a melting condition in a part for a joint 10. In a part for a joint 10, the housing base 7 and a housing cover 8 are combined by this, it solidifies at the following cooling process, and welding is formed.

Then, when required, annealing can be performed in order to mitigate the welding stress in a part for a joint 10. By moving the work-piece holder 4 and/or the optical system 3, or the source 1 of a laser beam, a part for the joint 10 annularly surrounded long and slender in housing 6 is formed. Since housing 6 can also be welded in each location in a suitable case, although it is not continuing, a part for the joint whose cross section is a letter of a partition is obtained.

Suitably, since welding stress is low in welding of the letter of a partition, it is not necessary to perform annealing next.

In housing 6, a part for a joint 10 can be prepared in the three-dimensions space in which orientation is possible at arbitration by moving relatively the source 1 of a laser beam or the optical system 3, and the work-piece sections 7 and 8. It is this purpose, for example, the work-piece holder 4 is designed by three dimensions as a movable multiaxial processor according to the arrow head 5. A robot can also be used similarly or the optical system 3 can be moved. Since space migration of a request of the work-piece holder 4 is programmable, a part for the joint 10 which has the shape of a space form of correspondence is respectively formed at the time of welding. It can form so that it may be easy to deal with a part for the joint 10 of a complicated configuration suitable especially in the case of the electric switch housing 6 and it may be equipped with flexibility.

It is located in the interior of housing 6 by the amount of [10] joint by the reasons of a design, and the amount of [10] joint laps with the shoulder 9, and it has joint as shown especially in drawing 2 . The contiguity lap joint 17 is formed in a housing cover 8 and the housing base 7 in the further example shown in drawing 4 . In the example shown in drawing 5 , the housing base 7 and a housing cover 8 have the lap joint 18 of a wedge configuration. A part for a joint 10 is partially formed in the interior of housing 6 at least also in these examples.

In the example shown in drawing 6 , the lap joint 19 of a shoulder configuration is formed further. Work pieces 7 and 8 have respectively the shoulder 20 and 20' which have been projected from the actual wall, and a part for a joint 10 is formed in the shift section between the projected shoulder 20 and 20'. A laser beam 11 acts almost perpendicularly to the protrusion shoulder 20 of protrusion shoulder 20' and the opposite side in this example. The configuration of others of the joint of a shoulder configuration is shown

in drawing 7 and 8. In the case of the joint 21 of the shoulder configuration of drawing 7 The stage-like acceptance section is prepared in the work-piece section 7, and the wall of the work-piece section 8 is inserted here. In drawing 8 , the wall with which the work-piece section 8 finally supports the acceptance section of the stairway configuration prepared in the work-piece section 7 is inserted so that the shoulder-like joint 22 may be formed.
Especially the groove lap joint 23 finally shown in drawing 10 also demonstrates the sealing effectiveness which was excellent as a labyrinth seal to invasion of the dust to housing 6. The protruding edge 25 prepared in the slot 24 currently formed in the wall of the work-piece section 8 for this purpose corresponding to the wall of the work-piece section 7 has fitted in. A laser beam 11 contacts in the field of a slot 24 almost at right angles to the front face of the work-piece section 8, and a part for a joint 10 is formed in the side which faces this field of the work-piece section 8 between a protruding edge 25 and a slot 24 by that cause.
The outline in the three-dimension space which a wall 26 has conforms to each meant use as shown in the sectional view of the work-piece section 6 in which drawing 9 is designed a little intricately. Such complicated housing 6 is used for the electric switch of electric equipment, and a cavity 27 is demarcated by the interior with the wall 26 of the work-piece section 8, and holds the functional division of an electric switch in it. In order to protect a cavity 27 from dust, as drawing 10 was explained, the protruding edge 25 of the work-piece section 7 fits into the slot 24 established in the wall 26.
Since a part for the joint 28 of the letter of a partition is prepared in the slot 24 as furthermore shown in drawing 9 , the two work-piece sections 7 and 8 are welded on the front face which has connected mutually. The amount of [of the letter of a partition / 28] joint has the path of a hook configuration or a zigzag configuration, and this is formed by moving relatively a laser beam 11 and the work-piece sections 7 and 8 programmable in three-dimensions space. The amount of [28] joint consists of each partition rather than it consists of continuous space. Especially these are the deflection points that the part of the angle of a wall 26 or the direction of welding changes suddenly. Furthermore, although a penetration part etc. is not illustrated, a shaft, a ** rod, etc. can also prepare a part for the joint of the letter of a partition in the field which has rushed into the cavity 27 of housing 6 from an outside. Although it is necessary to seal such a field especially, the seal is certainly carried out by the amount of [of the letter of a partition / 28] joint.
Since it is only a straight line-like between each partitions for a joint 28, it is not necessary to carry out a seal by the not much complicated approach. In this case, a sealing slot is enough formed only by piling each other up without welding a slot 24 and a protruding edge 25 on the wall 26 of the work-piece sections 7 and 8. In order to support this, the connection side of the wall 26 of the two work-piece sections 7 and 8 is mutually forced by preparing snap connection 29 grade further between the partitions for a joint 28, where sealing is carried out in these fields. Since only a part for the joint 28 of the letter of a partition is prepared in this example, time amount is reduced in case the work-piece sections 7 and 8 are welded.
In order to fully heat a part for a joint 10, the properties of as opposed to [in / at least / a subsegment] the spectrum of a laser beam 11 in the housing base 7 and a housing cover 8 differ. For example, while the housing cover 8 of the transmission coefficient of a laser beam 11 is larger than the housing base 7, the housing base 7 of an absorption coefficient is conversely larger than a housing cover 8. It is mutually located relatively so that a laser beam 11 may hit a housing cover 8 in a part for the first bond part 12 which are a part for a joint 10, and the opposite side as indicated in drawing 3 as the two work-piece sections 7, i.e., the housing base, and the housing cover 8, and the optical system 3 of the source 1 of a laser beam.
Since the transmission coefficient is high, the first work-piece section 8, i.e., a housing cover, is made as [penetrate / partially / at least / the spectrum of a laser beam 11] in the field from a part for the first bond part 12 to a part for a joint 10. Consequently, a part of laser beam [at least] 11 penetrates a housing cover 8.
The transparency part of a laser beam 11 invades into the second work-piece section 7, i.e., the housing base, as shown to drawing 3 by part for the second bond part 13. It is located in the straight line currently formed of the laser beam 11 by the amount of [13] part for the first bond part 12, and second bond part on parenchyma as illustrated. This straight line is almost perpendicular to parts for a bond part 12 and 13 especially.
Since the absorption coefficient is high, the housing base 7 is made as [absorb / partially / at least / the spectrum of a laser beam 11] in the field for the second bond part 13 for a joint 10. Consequently, the housing base 7 is heated in the absorption field 14 by a part of laser beam [at least] 11 in contact with a part for the second bond part 13. or [being made as / carry out / the housing base 7 / on the front face for the second bond part 13 / in this example / extinction] -- or it is formed only in the front face of the housing base 7 as it comes out enough and it is, if it is chosen so that the several microns laser beam 11 may trespass [the wavelength of the laser beam 11 used] upon the housing base 7 slightly and preferably, and the

absorption field 14 is shown in drawing 3 by that cause. Since heat is penetrated by the adjoining housing cover 8 from the absorption field 14, a housing cover is similarly heated in the heat-conduction field 15. By heating the absorption field 14 and the heat-conduction field 15, melting of the plastics is carried out and, thereby, a part for the solidified joint 10 is formed common to these two parts 14 and 15 after cooling.
As mentioned above, housing 6 consists of plastics. It is proved that it is appropriate in especially this example to use a styrene acrylonitrile copolymer, a polyamide, etc. as housing of an electric switch. In order to adjust the partial permeability of the housing cover 8 to the spectrum of a laser beam 11 and the partial absorptivity of the housing base 7, i.e., a transmission coefficient, and an absorption coefficient, a pigment, a glass fiber, etc. are used for plastics. In this case, accommodation is performed by changing the rate of the additive in the two work-piece sections 7 and 8. A rate is chosen so that the reflection factor of the two work-piece sections 7 and 8 to the spectrum of a visible ray may become the same on parenchyma. It was discovered that it is suitable to make the absorption coefficient of the housing base 7 high especially with a black pigment. While adding the pigment to the partial absorption plastics of the housing base 7 1% to 2% by testing the plastics of the mold mentioned above, it was shown in the plastics of the partial transparency housing cover 8 that it is convenient to add the pigment of a lower rate, or not to add a pigment when special. Therefore, the two work-piece sections 7 and 8 do not let a visible ray pass on parenchyma, but in order to give an almost equal visual effect, they are colored black. Therefore, since the two work-piece sections 7 and 8 of housing 6 give the same impression on vision to a convenient thing, it is not a foregone conclusion that accommodation is changed for every plastics.
Nd of 10W output which takes out a laser beam with the wavelength of about 1.06 micrometers suitable for especially the plastics of the mold mentioned above: When the advanced speed of the housing 6 to the optical system 3 was tested by 3 m/min by the YAG laser, and maintaining the following parameters, it turned out that a result with sufficient welding is obtained. Nd: To the spectrum of an YAG laser beam, a housing cover 8 is equipped with 60% or more of permeability T, and 30% or less of absorption coefficient A, and to be required, it is necessary to equip 20% or less of reflection factor R. Furthermore, the housing base 7 is equipped with 90% or more of absorption coefficient, and very few permeability T, and especially, to be required, it is necessary to equip 10% or less of reflection factor R. In the case of this example, this percentage is related with the laser beam 11 in contact with parts for a bond part 12 and 13. Since the rate of a laser beam 11 which is reflected by parts for each bond part 12 and 13 T+A+R=100% in each case does not not much have effect in heating for a joint 10, it must emphasize by adjusting plastics that it is also necessary to lessen as much as possible.
In order to improve the quality of welding, while heating and fusing a part for a joint 10 by the laser beam 11, a pressure can be made to act on a part for a joint 10 after that. The pressure roller 16 acts on the upper part of a housing cover 8 in the field for a joint 10 as shown in drawing 1 for this purpose. The pressure roller 16 is made as [pursue / to compensate for advance of the work-piece holder 4 to direction arrow-head 5' / a laser beam 11]. Therefore, the pressure of the pressure roller 16 acts until the amount of [10] joint cools, the recess of the dissolution from a part for a joint 10 is barred by that cause, and the danger that a void will be formed in a part for a joint 10 is prevented. Since this pressure acts in accordance with the focus of a laser beam 11 as shown in drawing 1 , a laser beam 11 is not barred in a part for the bond part 12 of a housing cover 8. Needless to say, although not illustrated instead of the pressure roller 16, in itself, the presser-foot equipment of water pressure, pneumatic pressure, and others which is common knowledge is also usable, and since these can carry out orientation of the beam to arbitration, they may be prepared in the outside of the path of a laser beam 11. When these presser-foot equipments consist of an ingredient which makes the spectrum of a laser beam 11 penetrate considerably, these presser-foot equipments can be located in the path of a laser beam.
The quality of welding at the point that automatic control of the operation parameter of the source 1 of a laser beam is continuously carried out as a function of the process parameter for a joint 10 is influenced [still more nearly affirmative]. These process parameters are temperature, a pressure, etc. When it is measured continuously and deflection arises from the set point, the operation parameter of the source 1 of a laser beam is changed into the desired set point according to deflection until it reaches again.
This invention is indicated and is not limited to the illustrated example. All development by this contractor of an invention concept within the limits is included rather. For example, this invention is usable in the work piece of what kind of request which it is not only used for manufacture of an electric switch, but consists of plastics for household articles, a package, etc., housing, etc.
1: Source 2 of a laser beam: Lightguide 3: Optical system 4: The work-piece holder 5, 5': Direction arrow head 6: Housing 7: Housing base (the second work-piece part)

8: Housing cover (the first work-piece part)
9: Shoulder 10: A part for a joint 11 : Laser beam 12: A part for the first bond part 13 : A part for the second bond part 14 : Absorption field 15: Heat-conduction field 16: Pressure roller 17: Contiguity lap joint (further configuration)
18: Joint (further configuration) of a wedge configuration
19: Lap joint (further configuration) of a shoulder configuration
20 20' : Protrusion shoulder 21: Joint (further configuration) of a shoulder configuration
22: Joint (further configuration) of a shoulder configuration
23: Groove lap joint 24: Slot 25: Protruding edge 26: Wall 27: Cavity 28: A part for the joint 29 of the letter of a partition : Snap connection

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DRAWINGS

[Drawing 1]

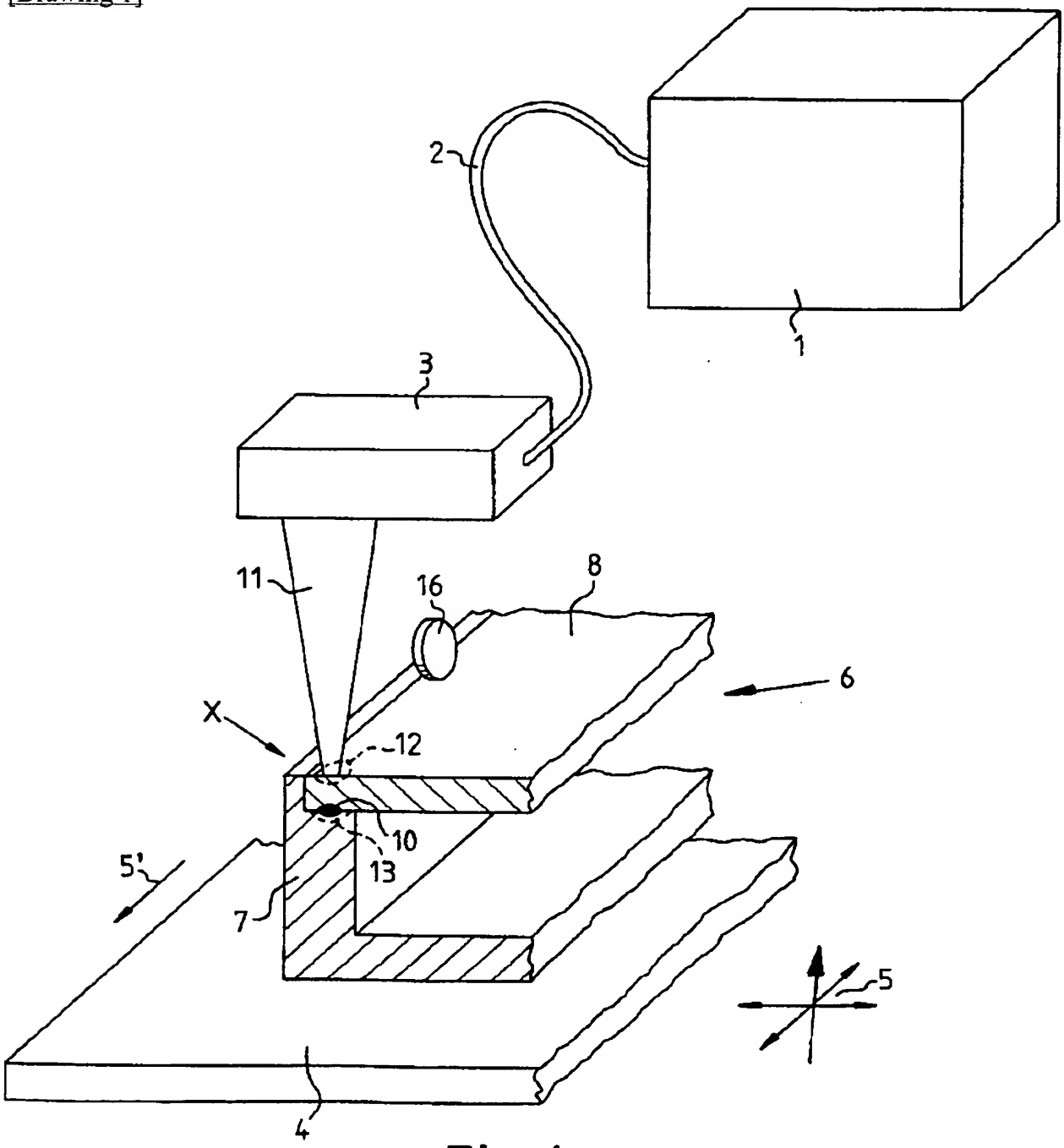

Fig.1

[Drawing 2]

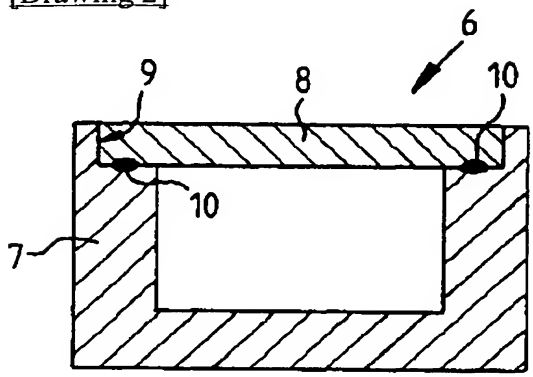

Fig. 2

[Drawing 3]

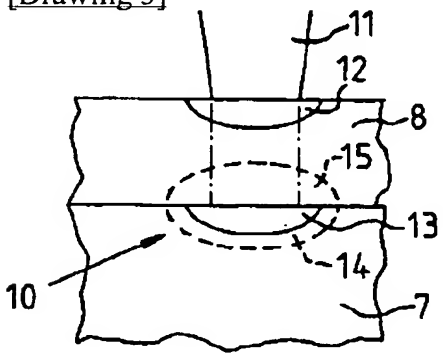

Fig. 3

[Drawing 4]

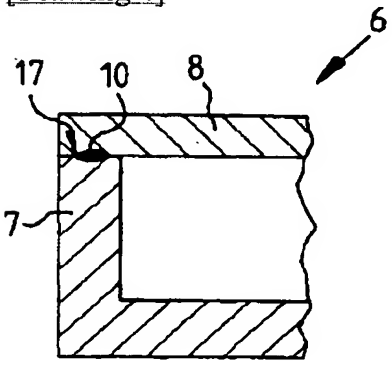

Fig. 4

[Drawing 5]

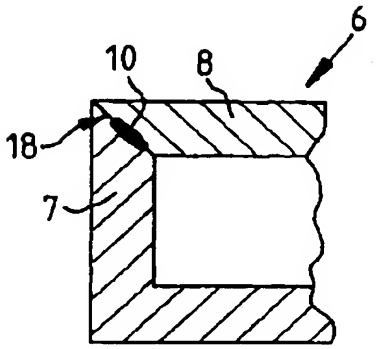

Fig.5

[Drawing 6]

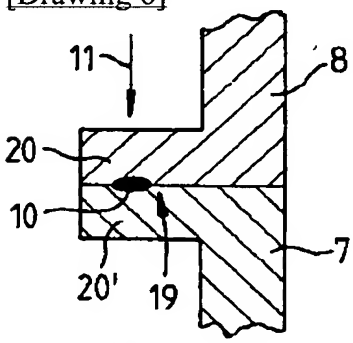

Fig.6

[Drawing 7]

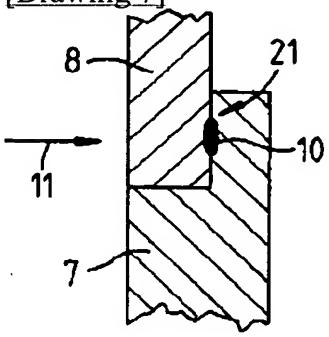

Fig.7

[Drawing 8]

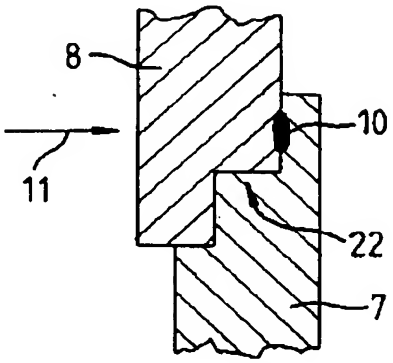

Fig. 8

[Drawing 9]

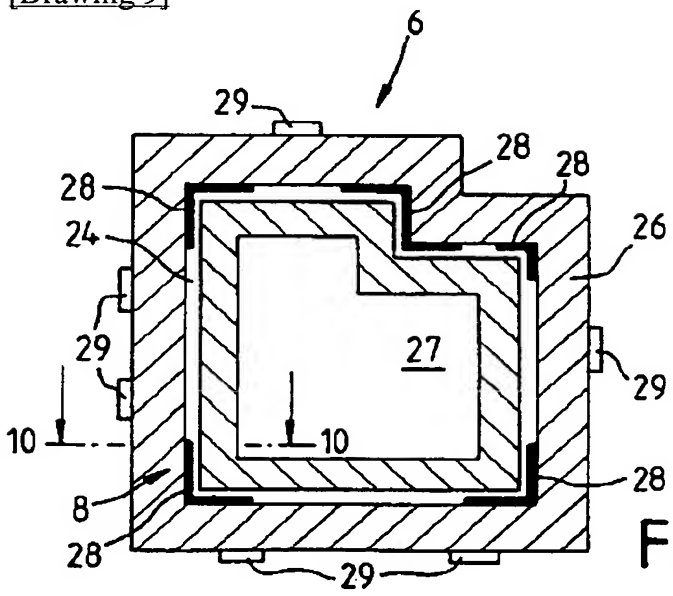

Fig. 9

[Drawing 10]

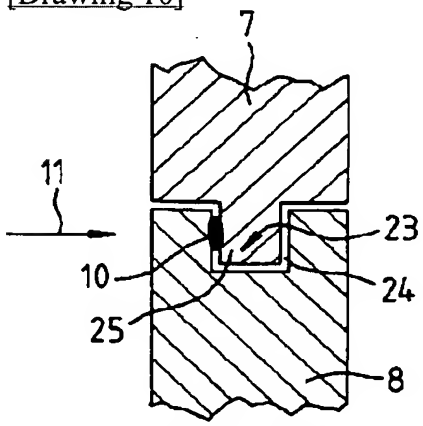

Fig.10

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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４．補正対象書類名

　　請求の範囲

５．補正対象項目名

　　請求の範囲

６．補正の内容

（１）請求の範囲を別紙の通り補正する。

別紙

請求の範囲

1．ワークピース、特に電気スイッチのハウジング（6）であって、少なくとも小区域において、レーザービーム（11）のスペクトルに対して互いに異なる透過係数及び吸収係数を有し、接合部分（10）に沿ってレーザービーム（11）により溶接される、プラスチック、好ましくは熱可塑材からなる二つのワークピース部（7，8）が設けられ、第一ワークピース部（8）は第一結合部分（12）の領域においてレーザービーム（11）を透過するようになされ、レーザービーム（11）は第一ワークピース部（8）の接合部分（10）に侵入し、それによりレーザービーム（11）の一部が第一ワークピース部（8）を貫通し、第二結合部分（13）で第二ワークピース部（7）に侵入し、さらに、第二ワークピース部（7）は接合部分（10）の第二結合部分（13）の領域においてレーザービーム（11）を吸収するようになされ、第一ワークピース部（8）の透過係数及び第二ワークピース部（7）の吸収係数は、プラスチックにおける添加物、例えばガラス繊維、顔料、特に黒の顔料の割合によって調節されることによって、第一ワークピース部（8）は第一結合部分（12）から接合部分（10）までの領域においてレーザービーム（11）のスペクトルを少なくとも部分的に透過し、第二ワークピース部（7）は第二結合部分（13）の領域においてレーザービーム（11）のスペクトルを少なくとも部分的に吸収し、可視光線のスペクトルに対する二つのワークピース部（7、8）の反射率は実質上、同じであるワークピース。

2．第二ワークピース部（7）が第二結合部分（13）の表面で吸収するようになされ及び／又はレーザービーム（11）の波長が、レーザービーム（11）が第二ワークピース部（7）にわずかに、好ましくは数ミクロンのみ侵入するように選択され、その結果、レーザービーム（11）の吸収領域（14）は第二ワークピース部（7）に表面的に形成される請求項1記載のワークピース。

3．二つのワークピース部（7、8）が同じプラスチック、例えばスチレン－アクリロニトリル共重合体またはポリアミドからなり、吸収プラスチックの場合、1％～2％の染料で着色を行い、透過プラスチックの場合、より低い率の着色を

行うか、おそらく着色を行わないことが好適であり、さらに両方のワークピース部（７、８）のプラスチックは実質上、可視光線のスペクトルを透過しないことが好適である請求項１又は２記載のワークピース。

４．ワークピース（７、８）の結合部分（１２、１３）に当たるレーザービーム（１１）に関して各々、第一ワークピース部（８）が６０％以上の透過率Ｔ、３０％以下の吸収率Ａ、必要な場合、２０％以下の反射率Ｒを有し、第二ワークピース部（７）が９０％以上の吸収率Ａ、特にごくわずかな透過率Ｔ、必要な場合、１０％以下の反射率Ｒを有している請求項１ないし３のいずれかに記載のワークピース。

５．接続するべきワークピース部（７、８）は接合部分（１０）において、重なりジョイント（９）、必要な場合はくさび形状の重なりジョイント（１８）、溝状の重なりジョイント（２３）、ショルダ状の重なりジョイント（９、１９、２１、２２）又は隣接重なりジョイント（１７）を備え、接合部分（１０）は好ましくはワークピース部（７、８）の接続に沿って三次元空間に設けられ、さらに接合部分（１０）の一部がワークピースの内部に位置することが好適である請求項１から４のいずれかに記載のワークピース。

６．内側の空胴（２７）の少なくとも一部によって画定されている壁（２６）が二つのワークピース部（７、８）に設けられ、好ましくは接合部分（１０）が個々の区分（２８）からなり、該区分は壁（２６）の角又は空胴（２７）の貫通部分の領域に設けられ、互いに隣接している壁（２６）の接続表面に沿って連続し、さらに、個々の区分（２８）の間で壁（２６）が互いにスナップ接続（２９）又はシール溝（２４）で重なり合うことによって、特にほこりから空胴（２７）をシールすることが好適である請求項１から５のいずれかに記載のワークピース。

７．プラスチック、好ましくは熱可塑材からなる、請求項１から６のいずれかに記載のワークピース部（７、８）、特に電気スイッチのハウジング部をレーザービーム（１１）によって溶接する方法であって、第一透過ワークピース部（８）及び第二吸収ワークピース部（７）を互いに接合部分（１０）によって接続し、ワークピースを形成し、レーザービーム（１１）が最初に第一結合部分（１２）で第一ワークピース部（８）に当たるように、二つのワークピース部（７、８）

及びレーザービーム源（１）を光システム（３）によって互いに相対的に位置づけ、それによりレーザービーム（１１）の一部は第一ワークピース部（８）を貫通し、レーザービーム（１１）のこの部分は次に第二ワークピース部（７）の接合部分（１０）の第二結合部分（１３）の領域に侵入し、それにより第二ワークピース部（７）は第二結合部分（１３）の領域が加熱され、その結果、二つのワークピース部（７、８）は接合部分（１０）において溶融状態になり、次の冷却時、接合部分（１０）は固化され、二つのワークピース部（７、８）は各々、添加剤、特に顔料を含み、第一ワークピース部（８）が第一結合部分（１２）から接合部分（１０）までの領域において、少なくとも部分的にレーザービーム（１１）のスペクトルを透過するように、添加剤の割合を変えることによってワークピース部（７、８）は調節され、第二ワークピース部（７）は第二結合部分（１３）の領域において、少なくとも部分的にレーザービーム（１１）のスペクトルを吸収し、可視光線のスペクトルに対する二つのワークピース部（７、８）の反射率は実質上、同じである方法。

８．二つのワークピース部（７、８）で第一結合部分（１２）及び第二結合部分（１３）が実質上、レーザービーム（１１）によって形成されている直線上に、特に該線に対してほぼ垂直に位置するように、光システム（３）によってレーザービーム（１１）が向けられるようにレーザービーム源（１）が位置し、細長い接合部分（１０）が形成され、任意に配向可能で、ワークピースにおいて三次元空間に個々の位置で区分状（２８）に設けられるように、レーザービーム源（１）もしくはレーザービーム源（１）の光システム（３）及びワークピース部（７、８）が好ましくは互いに相対的に、特にロボット又は多軸取扱装置のようなプログラム可能な動きで移動する請求項７記載のワークピース部の溶接方法。

９．レーザービーム（１１）による接合部分（１０）の加熱及び溶融時、又はその後、圧力が接合部分（１０）の領域に、特に接合部分（１０）の冷却まで作用され、好ましくは圧力はレーザービーム（１１）の焦点に沿って、特にレーザービーム（１１）を追跡し又はレーザービーム（１１）の経路の外側でワークピース部（７、８）に作用し、好ましくは水圧、空気圧又はローラ状（１６）の、レーザービーム（１１）を透過することができる押え装置によって圧力作用がもた

らされる請求項７又は８記載のワークピース部の溶接方法。

１０．レーザービーム源（１）、好ましくはＮｄ：ＹＡＧレーザーの操作パラメータが接合部分（１０）における温度及び／又は圧力の工程パラメータの関数として自動制御され、ワークピースが好ましくは溶接後、焼鈍されることによって溶接応力が軽減される請求項７ないし９のいずれかに記載のワークピース部の溶接方法。

[Translation done.]